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Making Fertilizer Recommendations from Soil Test Reports

Purpose

The purpose of the technical note is to provide producers, agricultural agents and crop advisors with the tools to better understand and interpret soil test reports for Alaska soils. Soil test results are used to determine fertilizer rates and any need for soil amendments such as lime. Included in this technical note are four crop specific recommendation tables that can be used to make fertilizer recommendations from soil tests taken in Alaska.

Soil Tests

Soil tests are designed to extract a portion of an essential plant nutrient from the soil. The results of these tests can be correlated with the availability of that nutrient for uptake by plant roots, and therefore, the need for additional amounts of the nutrients for good crop growth and yield. Most soil tests are indexes of nutrient availability rather than measures of absolute amounts. Indexes tell whether nutrient availability is low, adequate or high. This is more useful than knowing total amounts, because not all of a nutrient (often less than 1%) in the soil is in a form that plants can use.

The use of relative indexes, rather than total amounts, means that different types of soil tests for the same nutrient can differ numerically – even though they are all "good" soil tests. However, some soil tests are better adapted to the characteristics of soils in different regions of the country. They work better on those soils than alternative procedures. For this reason, it is important to use the specific soil tests that are best suited for Alaska soils.

In order to make fertilizer recommendations from soil test reports Alaska landowners should select laboratories that at a minimum will provide the following analyses:

Nitrogen: nitrate (NO_3^--N) and ammonium (NH_4^+-N) using the 2 Normal KCl extraction method
Phosphorus: Mehlich-3 extraction method
Potassium: Mehlich-3 extraction method
Soil pH: 1:1, soil:water method
Buffer pH for Lime Requirement: SMP Buffer method

Additional analyses should be requested especially when crop nutrient deficiencies or excesses are suspected. These analyses include: Soil Organic Matter (SOM), Sulfur (S), Magnesium (Mg), Calcium (Ca), Manganese (Mg), Zinc (Zn), Copper (Cu), Boron (B) and cation exchange capacity (CEC).

Soil Test Numbers

Generally soil nutrients will be reported in parts per million (ppm) specific soil test element or compound and/or pounds per acre (lbs/A) specific soil test element or compound.

The following table provides a general range of values associated with soil test values in Alaska.

ELEMENT	UNITS	TYPICAL RANGE IN ALASKA SOIL	EXCESSIVE
Nitrogen	ppm NO_3^--N & NH_4^+-N	2-75	>100
Phosphorus	ppm-P	1-36	>60
Potassium	ppm-K	10-200	>250
Sulfur	ppm-S	5-40	>50
Boron	ppm-B	0-.5	>1
Zinc	ppm-Zn	0.1-20	>40
Manganese	ppm-Mn	0.1-60	>60
Copper	ppm-Cu	0.1-10	>20
Calcium	meq-100 g soil	5-50	>200
Magnesium	meq-100 g soil	2-30	>100
Sodium	meq-100 g soil	0.1-10	>3
pH		4-9	Crop Dependent
Soluble Salts	m.mho/cm	0.1-10	>5
Organic Matter	%	0.1-12	-

NUTRIENTS

Nitrogen (N) - Nitrogen is essential to nearly every aspect of plant growth. It is a major component of protein and critical for crop quality as well as growth. Nitrogen is highly water soluble and subject to leaching from soil. Certain forms of nitrogen are volatile and are released into the air following surface application of fertilizer or manure. Nitrogen is also mobile within plant tissue so nitrogen will move within the plant to actively growing or developing plant parts.

Nitrogen is absorbed from the soil as nitrate (NO_3^-) and ammonium (NH_4^+). This soil test estimates their current levels. Soil nitrogen levels in Alaska generally range from 2 to 75 ppm total NO_3^- and NH_4^+. Fertilizer recommendations are not generally made on the basis of these measurements because their levels can fluctuate greatly with soil and weather conditions over short periods of time. Instead, they are used to assess extremes of nitrogen fertility. For example, very high ammonium ($NH_4^{+)}$ levels can be

toxic to the roots of many plants, particularly if the soil pH is above 7. Very high levels of either form may coincide with fertilizer “burn." Recommendations are made on the presumptions that very little nitrogen remains in the soil after the growing season and that most crops require between 1 and 4 lbs of nitrogen per 1000 square feet per year (40 to 175 lbs of nitrogen per acre). It is recommended that pre-plant nitrate tests be done just prior to planting to determine after winter nitrogen levels in the soil. Pre-plant nitrogen levels can then be used to adjust nitrogen fertilizer recommendations to consider existing nitrate levels in the soil.

In Alaska many soils have high levels of soil organic matter (SOM). Typically high levels of SOM provide a source of plant available nitrogen during the growing season, especially in warmer climates. For example in Minnesota a soil with 3% organic matter contains about 3,000 pounds of nitrogen per acre and would be expected to provide, through decomposition and mineralization, about 60 pounds of plant available nitrogen during the growing season. In Alaska research also shows that significant amounts of N are mineralized in agricultural soils; however, we lack solid numbers to estimate the amount of mineralization that occurs. Additionally much of the organic matter in newer fields is from woody debris which is much lower in N than organic matter from crop residue. For these reasons Alaska nitrogen fertilization recommendations in this technical note do not reflect any nitrogen credits generally correlated with SOM levels and release.

Soil test nitrogen can serve as a good indicator of trends in soil quality. If over time soil tests continue to show increases in nitrogen it is being applied in excess of the crop need. It may be profitable to reduce nitrogen application rates. If SOM levels are declining over time a crop rotation and tillage program aimed at improving soil quality could increase the organic matter content and improve the soils ability to store plant nutrients.

Phosphorus (P) or Phosphorus Pentoxide (P_2O_5) - Among other important functions, phosphorus provides plants with a means of using the energy harnessed by photosynthesis to drive its metabolism. A deficiency of this nutrient can lead to impaired vegetative growth, weak root systems, and fruit and seed of poor quality and low yield. Soil phosphorus exists in a wide range of forms. Some is present as part of soil organic matter and becomes available to plants as the organic matter decomposes. Most inorganic soil phosphorus is bound tightly to the surface of soil mineral particles. Alaska has many soils that are classified as tephra-affected soils (soils with properties dominated by weathered volcanic glass). Not only is the volcanic glass mineral content of these soils high, but these minerals have been sufficiently weathered to produce significant amount of allophone, active aluminum, and acidity. Soils with high active aluminum can quickly bind fertilizer phosphorus resulting in a decreased yield response as much of the fertilizer phosphorus becomes unavailable. Warm, moist, well aerated soils at about pH 6.5 optimize the release of both these forms; therefore, in Alaska’s cold soils phosphorus release can be low, especially during cold spring conditions, and most crops in Alaska will require starter fertilizers containing phosphorus. This is especially critical since phosphorus is essential for good root establishment early in the

growing season. Plants require fairly large quantities of phosphorus, but the levels of phosphorus available to plant roots at any one time are quite low. Soil tests attempt to assess the soil's ability to supply phosphorus from bound forms during the growing season. Soil test phosphorus levels in Alaska usually range from 2 to 36 ppm P.

Potassium (K) or Potash (K_2O) - Potassium rivals nitrogen as the nutrient element absorbed in greatest amounts by plants. Like nitrogen, a relatively large proportion of plant-available potassium is taken up by crops each growing season. Plants deficient in potassium are unable to utilize nitrogen and water efficiently, and are more susceptible to disease. Most available potassium exists as an exchangeable cation. The slow release of potassium from native soil minerals can replenish some of the potassium lost by crop removal and leaching. This ability, however, is limited and variable. Fertilization is often necessary to maintain optimum yields. Soil test potassium levels in Alaska usually range from 10 to 200 ppm K. K is relatively abundant in Alaska soils, especially in the interior, and soil test levels are generally show adequate amounts of K in the soil for most crops.

Calcium (Ca) - Calcium is essential in the proper functioning of plant cell walls and membranes. Sufficient calcium must also be present in actively growing plant parts, especially storage organs such as fruits and roots. Soils with normal pH ranges with constant and adequate moisture will normally supply sufficient calcium to plants; therefore, acid soils in Alaska should be monitored for adequate calcium levels.

Magnesium (Mg) - Magnesium acts together with phosphorus to drive plant metabolism and is part of chlorophyll, a vital substance for photosynthesis. Like calcium, magnesium is ordinarily available in adequate amounts in soils with neutral pH ranges. Low magnesium levels in many soils will normally not cause problems provided the exchangeable cations are in good balance. If magnesium levels are low due to low pH values dolomitic lime (rich in Mg) can be applied to both raise pH and to add magnesium to the soil.

Aluminum (Al) - Aluminum is not an essential nutrient for plants. At elevated levels it can be extremely toxic to plant roots and limit the plant's ability to take up phosphorus. Extractable aluminum increases greatly at soil pHs below 5.5. If aluminum toxicity is a problem soils should be limed to lower aluminum to acceptable levels. Aluminum sensitivity varies greatly with plant type. Acid-loving plants, such as rhododendrons, can tolerate very high aluminum levels. Lettuce, carrots and beets are very sensitive. Alaska has many soils that are classified as tephra-affected soils (soils with properties dominated by weathered volcanic glass) where not only is the volcanic glass mineral content of these soils high, but these minerals have been sufficiently weathered to produce significant amount of allophone, active aluminum, and acidity. Soils with low pH and high aluminum should be limed to reduce acidity and lower aluminum levels.

Sulfur (S) or Sulfate Sulfur ($SO_4^=$-S) - Sulfur is absorbed by plants as the sulfate anion, $SO_4^=$. Sulfur is a component of three of the 21 essential amino acids and thus, is critical to the formation and function of proteins. Sulfur deficiency causes plants to become light

green and stunted. Most crops require about 1/20 the amount of sulfur that they do of nitrogen. Bumper yields of most crops can be supported by 5 to 15 lb/acre of sulfur. Sulfur is found in soil in the form of soil organic matter, dissolved in the soil solution as the sulfate ion, and as a part of the solid mineral matter of soils. Many crops grown in Alaska, especially in the interior region, show a response to the addition of sulfur.

Soluble Salts - Soluble salts (SS), such as those used on roads to promote melting and those present in many commercial (and some natural) fertilizers, can cause severe water stress and nutritional imbalances in plants. Generally, seedlings are more sensitive than established plants to elevated soluble salt levels and great variation exists between plant species. Most soils have soluble salt values or electrical conductivity between 0.08 and 0.50 micro ohms per centimeter (mmho/cm). The middle of this range is typical of most fertile mineral soils. Values higher than 0.60 mmho/cm may cause damage to sensitive plants (such as onions, etc.). A soluble salt level can change rapidly in the soil due to leaching (washing out), so evaluating its significance must consider the effects of time and growing conditions. Excessive soluble salt levels can often be corrected by leaching with liberal amounts (2 to 4 inches) of fresh water.

Soil pH, Buffer pH, and pH adjustments - Soil pH is a measure of the soil's acidity and is a primary factor in plant growth. When pH is maintained at the proper level for a given crop, plants nutrients are at maximum availability, toxic elements are often at reduced availability, and beneficial soil organisms are most active. Most plants prefer a soil pH between 5.5 and 7.5 and the majority do best with soil test pH levels of 6.5 to 7.0. Some notable acid-loving exceptions are blueberries and rhododendrons. Due to the parent material from which many of the soils of Alaska are formed, some soils in Alaska tend to be naturally very acidic (4.5 - 5.5). For this reason they must often be amended with materials capable of raising the pH. Many products are available to accomplish this, but ground limestone is the most common. In the northern areas of the state, soils tend to have pH values in the 8 range. In the interior farming areas soil pH can be closer to 7, especially in areas where repeated tillage has mixed neutral sub soil materials with the surface soil.

Due to the high cost of liming materials in Alaska landowners should consider, especially with new plantings or cropping systems on recently cleared ground, selecting crop varieties that will perform best at the pH range reflected in their soil test results. For example a field with a pH of 5.5 would require significant pH adjustment to produce a good crop of brome; however, the same field may support timothy production without the addition of lime. In many cases choosing a crop better adapted to a field's natural pH can be more beneficial than planting a crop that will require a large soil pH adjustment or increased fertilizer applications to produce profitable yields. In an effort to overcome plant health and production issues on low pH soils higher rates of nitrogen fertilizer are often applied. The sustained use of nitrogen fertilizers tends to increase soil acidity during the nitrification process in the soil thereby compounding the problem by decreasing soil pH.

Soil pH can be increased by liming; however, accurate lime recommendations cannot be made solely on the basis of soil pH. The soil pH test indicates ***if*** lime is needed. The SMP buffer test determines ***how much*** lime is needed. The SMP buffer test is a measure of the soil's capacity to resist pH change after lime has been added. Two soils with the same soil pH may have quite different SMP buffer pHs, and thus one will require significantly more limestone than the other to obtain an optimal soil pH. Without an SMP buffer test there is no way to know how much lime is required to adjust soil pH to the desired level. See the NRCS publication Alaska Agronomy Technical Note 15 – Liming Alaska Soils for more information about adjusting soil pH.

Cation Exchange Capacity - Cation exchange capacity (CEC) is an important measure of the soil's ability to retain and to supply nutrients. CEC is important because it represents the primary soil reservoir of readily available Potassium, Calcium, Magnesium and several micronutrients. Soils with high clay or organic matter content tend to have a high CEC. Sandy soils have a low CEC. The bulk of this capacity in Alaska soils resides in finely divided soil organic matter and from the soil's clay particles. The basic nutrient cations (positively charged ions) of Calcium (Ca^{++}), Magnesium (Mg^{++}), and Potassium (K^{+}), and the acidic cations of Aluminum (Al^{3+}) and Hydrogen (H^{+}) account for nearly all the adsorbed cations in the soil. Typically Alaska soils have low CEC's, ranging from 2 to 15. Due to the low clay content of most Alaskan soils, the CEC can best be managed in Alaska by improving soil quality and maintaining soil organic matter levels.

Micronutrients

Many soil testing laboratories also provide results for micronutrients such as Boron (B), Zinc (Zn), Manganese (Mn), Copper (Cu), Chloride (Cl), Nickel (Ni), Molybdenum (mo) and Iron (Fe). Availability of most micronutrients is largely pH dependent; availability decreases as pH increases (except for molybdenum, which becomes more available as pH increases). While major deficiencies seldom occur in soils with pH below 6.5 if any question exists about a possible micronutrient deficiency testing should be done. When a micronutrient deficiency or toxicity is suspected, plant tissue testing may be a better diagnostic tool than soil testing especially in high production vegetable crops, nurseries or greenhouses. In the interior many soils are considered to be deficient in Boron and Manganese and testing should be done to insure adequate levels are present to meet crop production needs.

Making Fertilizer Recommendations

Fertilizer recommendations can be made using soil test values and producer yield goals for crops listed in the guide sheets specifically for each Alaska region. Each guide sheet has a minimum of 4 sections, Nitrogen, Phosphorus, Potassium and References.

Soil test fertilizer recommendations for Nitrogen and Potassium (N and K) can be determined from the guide by using three factors and selecting the corresponding nutrient recommendation:

1. Soil test value,
2. Area of the state where crop is being grown, and
3. Producer yield goal.

Additional research data was available concerning Phosphorus (P); therefore, soil test fertilizer recommendations for P have the additional factor of soil series along with the three from above. By using these four factors the corresponding P nutrient recommendation can be determined. Please note that in the current research data, soil test values for phosphorus reflect very *narrow* ranges; therefore, individuals should use their best judgment to reconcile the soil test value with the appropriate range.

The references section of each guide sheet contains the specific references used in developing the guide sheet. An "Establishment Cultivars, Seeding Rate and Method; and Planting Date" section is found on the cereal crops, forage & grasses and potato guide sheets. This section lists the most common varieties of these crops grown in Alaska as well as seeding rate, seeding method, seeding depth and planting date. The Forage and Grasses guide sheet also has an "Establishment" section containing general fertilizer recommendations for new establishments of grass or forage.

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Alaska Soil Test Recommendation Guide Sheet: Grasses and Forages

Forages/Hay Grasses							
Nutrient	**Area**						
Nitrogen		**Soil Test Value**	**Very Low**	**Low**	**Medium**	**High**	**Very High**
Nitrogen (N), ppm	South-Central		0	10	20	30	31
	Timothy/Brome (Lbs N/AC) High YG*		80	80	60	40	40
	Timothy/Brome (Lbs N/AC) Avg YG*		80	60	40	20	20
	Timothy/Brome (Lbs N/AC) Maintenance*		40	40	40	20	20
	Annual Ryegrass Forage (Lbs N/AC) High YG*		100	100	75	50	25
	Annual Ryegrass Forage (Lbs N/AC) Avg YG*		100	75	50	25	25
	Cereals for Forage (Lbs N/AC)		60	60	45	30	15
Nitrogen (N), ppm	Interior		0	10	20	30	31
	Brome (Lbs N/AC) High YG* (2 cuts)		60	60	45	30	20
	Brome (Lbs N/AC) High YG* (N after 1st cut)		60				
	Brome (Lbs N/AC) Avg YG* (1cut)		60	45	30	20	20
	Brome (Lbs N/AC) Maintenance*		40	40	30	20	20
	Cereals for Forage (Lbs N/AC)		90	90	70	45	20
	Bluegrass or Red Fescue (Lbs N/AC) High YG*		60	60	45	30	20
	Bluegrass or Red Fescue (Lbs N/AC) High YG* (N after 1st cut)		60				
	Bluegrass or Red Fescue (Lbs N/AC) Avg YG*		60	45	30	20	20
	Bluegrass or Red Fescue (Lbs N/AC) Maintenance*		40	40	30	20	20
	Bluegrass or Red Fescue (Lbs N/AC) Delta Bison Range Avg YG*		70	70	50	35	10
	Bluegrass or Red Fescue (Lbs N/AC) Delta Bison Range Maintenance*		30	30	30	30	10
	Cereals for Forage (Lbs N/AC)		90	90	70	45	20
*** High Yield Goal > 2.5 tons/ac Average Yield Goal <2.5 tons/ac Maintenance: Retain Conservation Cover ONLY**							

Alaska Soil Test Recommendation Guide Sheet: Grasses and Forages

Phosphorus (P)		Soil Test Value	Very Low	Low	Medium	High	Very High
Phosphorus (P), ppm	Kenai Peninsula		4	8	13	17	21
	Beluga,Cohoe,Island,Kachemak,Kenai,Mutnala,Naptowne,Soldotna, and Tustumena Soil Series						
	Forage Lbs P_20_5/AC High YG*		90	69	43	23	10
	Forage Lbs P205/AC Avg YG*		90	50	35	10	10
	Forage Lbs P205/AC Maintainance*		20	10	10	10	10
	Cereals for Forage Lbs P_20_5/AC		90	69	43	23	10
Phosphorus (P), ppm	MacKenzie-Susitna Valley		4	7	10	13	16
	Chulitna,Flathorn,Homestead,Kashwitna,Nancy,Rabideaux,Schrock,Talkeetna, and Whitsol Soil Series.						
	Forage Lbs P_20_5/AC High YG*		90	68	45	23	10
	Forage Lbs P205/AC Avg YG*		90	50	35	10	10
	Forage Lbs P205/AC Maintainence*		20	10	10	10	10
	Cereals for Forage Lbs P_20_5/AC		90	68	45	23	10
Phosphorus (P), ppm	Matanuska Valley		43	46	49	52	55
	Bodenburg,Doone,Knik,Matanuska,Niklason,Susitna, and Homestead Soil Series mapped along the Mat River and foothills of Lazy Mountain.						
	Forage Lbs P_20_5/AC High YG*		80	60	40	20	10
	Forage Lbs P205/AC Avg YG*		80	45	30	15	10
	Forage Lbs P205/AC Maintenance*		20	15	15	15	10
	Cereals for Forage Lbs P_20_5/AC		80	60	40	20	10
Phosphorus (P), ppm	Copper River Basin		29	38	48	57	66
	Cleared Soils with a silt loam topsoil						
	Forage Lbs P_20_5/AC High YG*		80	60	40	20	10
	Forage Lbs P205/AC Avg YG*		80	45	30	15	10
	Forage Lbs P205/AC Maintenance*		20	15	15	15	10
	Cereals for Forage Lbs P_20_5/AC		80	60	40	20	10

Alaska Soil Test Recommendation Guide Sheet: Grasses and Forages

Phosphorus (P), ppm	Tanana Valley		6	8	11	13	15				
	Beales,Chena,Fairbanks,Gilmore,Goldstream,Jarvis,Nenana,Richardson,Salchaket,Steese,Tanana,Volkmar Soil Series										
	Forage Lbs P_20_5/AC High YG*		45	35	20	10	10				
	Forage Lbs P205/AC Avg YG*		45	25	15	10	10				
	Forage Lbs P205/AC Maintenance*		20	10	10	10	10				
	Cereals for Forage Lbs P_20_5/AC		45	35	20	10	10				
Potassium		**Soil Test Value**	**Very Low**	**Low**	**Medium**	**High**	**Very High**				
Potassium (K), ppm	MatSu, Kenai Peninsula		35	60	120	200	201				
	Forage Lbs K_20/AC High YG*		80	60	40	20	10				
	Forage Lbs K20/AC Avg YG*		80	45	30	15	10				
	Forage Lbs K20/AC Maintenance*		40	20	10	10	10				
	Cereals for Forage Lbs K_20/AC		60	45	30	15	10				
Potassium (K), ppm	Interior		35	60	120	200	201				
	Forage Lbs $K0_5$/AC High YG*		80	60	40	20	10				
	Forage Lbs K20/AC Avg YG*		80	45	30	15	10				
	Forage Lbs K20/AC Maintenance*		40	20	10	10	10				
	Cereals for Forage Lbs K_20/AC		20	10	10	10	10				
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Alaska Soil Test Recommendation Guide Sheet: Grasses and Forages

General Fertilizer Recommendations for Establishment

Forage Type	Area of state	N-P_20_5-K_20-S
Timothy & Bromegrass	Southcentral Alaska	60-60-60-0
Timothy, Bromegrass and Bluegrass	Interior Alaska	60-60-60-10
Bluejoint (Native)	Southcentral Alaska	100-60-60-0

Establishment Cultivars, Seeding Rate and Method; and Planting Date

Forage	Most Common Cultivars*	Seeding Rate	Seeding Method	Seed Depth	Planting Date
Timothy	Engmo; Adda; Korpa	5 lbs/acre	Drilled	1/2 inch	May/June to mid-July/mid-August
		10 lbs/acre	Broadcast	1/2 inch	May/June to mid-July/mid-August
Smooth Brome	Polar; Carlton; Manchar	9 lbs/acre	Drilled	1/4 -1/2 inch	May/June to mid-July/mid-August
		18 lbs/acre	Broadcast	1/4 -1/2 inch	May/June to mid-July/mid-August
Red Fescue	Actared; Boreal	6 lbs/acre	Drilled	1/4 -1/2 inch	May/June to mid-July/mid-August
		12 lbs/acre	Broadcast	1/4 -1/2 inch	May/June to mid-July/mid-August
Kentucky Bluegrass	Nugget; Park; Merion	6 lbs/acre	Drilled	1/4 -1/2 inch	May/June to mid-July/mid-August
		12 lbs/acre	Broadcast	1/4 -1/2 inch	May/June to mid-July/mid-August
Polargrass	Alyeska; Kenai	6 lbs/acre	Drilled	1/4 -1/2 inch	May/June to mid-July/mid-August
		12 lbs/acre	Broadcast	1/4 -1/2 inch	May/June to mid-July/mid-August
Bluejoint Reedgrass	Sourdough	2 lbs/acre	Drilled	1/4 -1/2 inch	May/June to mid-July/mid-August
		4 lbs/acre	Broadcast	1/4 -1/2 inch	May/June to mid-July/mid-August
Bering Hairgrass	Boreal; Norcoast	8 lbs/acre	Drilled	1/4 -1/2 inch	May/June to mid-July/mid-August
		16 lbs/acre	Broadcast	1/4 -1/2 inch	May/June to mid-July/mid-August
Slenderwheatgrass	Wainwright; Pryor; Revenue	6 lbs/acre	Drilled	1/4-3/4 inch	May/June to mid-July/mid-August
		12 lbs/acre	Broadcast	1/4 -1/2 inch	May/June to mid-July/mid-August
Tufted Hairgrass	Nortran	2 lbs/acre	Broadcast	1/4 inch	May/June
Bering Hairgrass	Norcoast	2 lbs/acre	Broadcast	1/4 inch	May 20 - July 10
American Sloughgrass	Egan	1 lb PLS/acre	Drilled	1/4-3/4 inch	May/June to mid-July/mid-August
Oats for Forage	Nip; Atahbasca; Cascade; Toral; Ceal	70-100 lbs PLS/acre	Drilled,6-7 in. rows	1/2 -2 inches	May/June
Barley for Forage	Otal; Datal; Wooding; Galt, Otra, Weal	70-100 lbs PLS/acre	Drilled,6-7 in. rows	1/2 -2 inches	May/June
Annual Ryegrass	Surrey; Marshall; Passerel Plus; Gulf	20-25 lbs/acre	Broadcast	1/4 - 1/2 inch	May/June to mid-July/mid-August
Legumes					
White Dutch Clover	Common	2 lbs/acre	Drilled	1/4 - 1/2 inch	May/June
Alsike Clover	Aurora	2 lbs/acre	Drilled	1/4 - 1/2 inch	May/June
Red Clover	Altaswede	2 lbs/acre	Drilled	1/4 - 1/2 inch	May/June
Ladino Clover	Pilgrim; Merit	2 lbs/acre	Drilled	1/4 - 1/2 inch	May/June
Alfalfa	Siberian	5 lbs/acre	Drilled	1/4 inch	May/June
Field Pea	Melrose; Glacier	60-100 lbs/acre	Drilled,7-8 inch rows	1-3 inches	May/June

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Alaska Soil Test Recommendation Guide Sheet: Cereal Crops

Cereal Crops

Nutrient	Area						
Nitrogen		**Soil Test Value**	**Very Low**	**Low**	**Medium**	**High**	**Very High**
Nitrogen (N), ppm	MatSu, Kenai Peninsula		0	10	20	30	31
	Grain (Lbs N/AC) High YG *		60	60	40	30	15
	Grain (Lbs N/AC) Avg YG *		60	40	30	15	10
	Canola (Lbs N/AC) High YG **		80	80	60	45	30
	Canola (Lbs N/AC) Avg YG **		60	45	30	15	10
Nitrogen (N), ppm	Interior		0	10	20	30	31
	Grain (Lbs N/AC) High YG *		80	80	60	40	20
	Grain (Lbs N/AC) Avg YG *		80	60	40	20	10
	Canola (Lbs N/AC) High YG **		80	80	60	45	30
	Canola (Lbs N/AC) Avg YG **		60	45	30	15	10
	* High Yield Goal > 40 bu/ac Average Yield Goal < 40 bu/ac						
	** Canola High Yield Goal > 20 bu/ac Average Yield Goal < 20 bu/ac						
Phosphorus		**Soil Test Value**	**Very Low**	**Low**	**Medium**	**High**	**Very High**
Phosphorus (P), ppm	Kenai Peninsula		4	8	13	17	21
	Beluga,Cohoe,Island,Kachemak,Kenai,Mutnala,Naptowne,Soldotna, and Tustumena Soil Series						
	Grain (Lbs P_20_5/AC) High YG *		75	55	40	30	10
	Grain (Lbs P205/AC) Avg YG *		60	45	30	15	10
Phosphorus (P), ppm	MacKenzie-Susitna Valley		4	7	10	13	16
	Chulitna,Flathorn,Homestead,Kashwitna,Nancy,Rabideaux,Schrock,Talkeetna, and Whitsol Soil Series.						
	Grain (Lbs P_20_5/AC) High YG *		75	55	40	30	10
	Grain (Lbs P205/AC) Avg YG *		60	45	30	15	10

Alaska Soil Test Recommendation Guide Sheet: Cereal Crops

Phosphorus (P), ppm	Matanuska Valley		43	46	49	52	55	
	Bodenburg,Doone,Knik,Matanuska,Niklason,Susitna, and Homestead Soil Series mapped along the Mat River and foothills of Lazy Mountain.							
	Grain (Lbs P_20_5/AC) High YG *		100	75	50	25	10	
	Grain (Lbs P205/AC) Avg YG *		80	60	40	20	10	
Phosphorus (P), ppm	Copper River Basin		29	38	48	57	66	
	Cleared Soils with a silt loam topsoil							
	Grain (Lbs P_20_5/AC) High YG *		100	75	50	25	10	
	Grain (Lbs P205/AC) Avg YG *		80	60	40	20	10	
Phosphorus (P), ppm	Tanana Valley		6	8	11	13	15	
	Beales,Chena,Fairbanks,Gilmore,Goldstream,Jarvis,Nenana,Richardson,Salchaket,Steese,Tanana,Volkmar Soil Series							
	Grain (Lbs P_20_5/AC) High YG *		75	60	35	20	10	
	Grain (Lbs P205/AC) Avg YG *		60	47	28	15	10	
Potassium		**Soil Test Value**	**Very Low**	**Low**	**Medium**	**High**	**Very High**	
Potassium (K), ppm	MatSu, Kenai Peninsula		35	60	120	200	201	
	Grain (Lbs K_20/AC) High YG *		60	60	45	15	15	
	Grain (Lbs K20/AC) Avg YG *		60	45	30	15	15	
Potassium (K), ppm	Interior		35	60	120	200	201	
	Grain (Lbs K_20/AC) High YG *		40	40	30	20	10	
	Grain (Lbs K20/AC) Avg YG *		40	30	20	10	10	
References:								

Michaelson, Gary J. and Ping, Chien Lu. Interpretation of the phosphorus soil test for Alaska agriculutral soils. University of Alaska Fairbanks Agricultural and Forestry Experiment Station Circular 66. 1999.

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Quarberg, Donald M. and Thomas R. Jahns. Alaska Cereal Grains Crop Profile. University of Alaska Cooperative Extension Service. 2006.

Alaska Soil Test Recommendation Guide Sheet: Cereal Crops

Establishment Cultivars, Seeding Rate and Method; and Planting Date

Grain	Cultivars*	Seeding Rate	Row Width	Seed Depth	Planting Date
Barley	Otal; Datal; Wooding; Galt, Otra; Weal; Finaska	70-100 lbs PLS/acre	6-7 inches	3/4 - 2 inches	May
Oats	Nip; Atahbasca; Cascade; Toral; Ceal	70-100 lbs PLS/acre	6-7 inches	3/4 - 2 inches	May
Wheat (HRSW)**	Hard Red Spring-Chena; Gasser; Ingal; Nogal; Froid; Vigal	70-100 lbs PLS/acre	6-7 inches	3/4 - 2 inches	May
Rye	Saskatoon (winter rye); Gazelle (spring rye)	70-110 lbs PLS/acre	6-7 inches	3/4 - 2 inches	May
Canola	Tobin (Polish Type); Legend (Argentine Type)	4-10 lbs PLS/acre	7-8 inches	< 1 inch	April 20-May 20

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**Hard Red Spring Wheat

Alaska Soil Test Recommendation Guide Sheet: Potatoes

Potatoes							
Nutrient	**Area**						
Nitrogen		**Soil Test Value**	**Very Low**	**Low**	**Medium**	**High**	**Very High**
Nitrogen (N), ppm	Statewide		0	10	20	30	31
	White and Red Skinned Varieties						
	Lbs N/AC High YG *		100	100	75	50	25
	Lbs N/AC Avg YG *		100	75	50	25	10
Nitrogen (N), ppm	Statewide		0	10	20	30	31
	Russet Varieties						
	Lbs N/AC High YG *		175	130	90	40	40
	Lbs N/AC Avg YG *		120	90	60	30	30
	* High Yield Goal > 15 tons/ac Irrigated and > 8 tons/ac Non-irrigated						
	* Average Yield Goal < 15 tons/ac Irrigated and < 8 tons/ac Non-irrigated						
Phosphorus		**Soil Test Value**	**Very Low**	**Low**	**Medium**	**High**	**Very High**
Phosphorus (P), ppm	Kenai Peninsula		4	35	66	97	128
	Cohoe, Island,Kenai,Naptowne,Soldotna Tustumena Soil Series						
	Lbs P_20_5/AC High YG *		320	240	160	80	50
	Lbs P205/AC Avg YG *		320	180	80	50	50
Phosphorus (P), ppm	Kenai Peninsula		4	55	107	158	209
	Beluga,Kachemak,Mutnala Soil Series and SE and SW AK						
	Lbs P_20_5/AC High YG *		320	240	160	80	50
	Lbs P205/AC Avg YG *		320	180	80	50	50
Phosphorus (P), ppm	MacKenzie-Susitna Valley		4	58	111	165	219
	Lbs P_20_5/AC High YG *		200	150	100	50	50
	Lbs P205/AC Avg YG *		200	150	50	50	50
Phosphorus (P), ppm	Matanuska Valley		43	70	96	123	150
	Lbs P_20_5/AC High YG *		320	240	160	80	50
	Lbs P205/AC Avg YG *		320	180	80	50	50

Alaska Soil Test Recommendation Guide Sheet: Potatoes

Phosphorus (P), ppm	Copper River Basin		29	52	74	97	120
	Lbs P_20_5/AC High YG *		200	150	100	50	50
	Lbs P205/AC Avg YG *		200	150	50	50	50
Phosphorus (P), ppm	Tanana Valley		6	61	115	170	225
	Beales,Chena,Fairbanks,Gilmore,Goldstream,Nenana,Steese Soil Series						
	Lbs P_20_5/AC High YG *		200	150	100	50	50
	Lbs P205/AC Avg YG *		200	150	50	50	50
Phosphorus (P), ppm	Kenai Peninsula		6	39	72	106	139
	Jarvis,Richardson,Salchaket,Tanana,Volkmar Soil Series						
	Lbs P_20_5/AC High YG *		200	150	100	50	50
	Lbs P205/AC Avg YG *		200	150	50	50	50

Potassium		**Soil Test Value**	**Very Low/Low**	**Medium**	**High**	**Very High**
Potassium (K), ppm	Statewide		75	150	300	301
	Lbs K_20/AC High YG *		180	120	60	10
	Lbs K20/AC Avg YG *		180	90	30	10

References:

Jahns, Thomas R. Alaska Potato Profile. University of Alaska Cooperative Extension Service. 2007.

Michaelson, Gary J. and Ping, Chien Lu. Interpretation of the phosphorus soil test for Alaska agriculutral soils. University of Alaska Fairbanks Agricultural and Forestry Experiment Station Circular 66. 1999.

Walworth, J.L. Field Crop Fertilizer Recommendations for Alaska Potatoes. Alaska Cooperative Extension Service Publication 100G-00246A. 1993.

Establishment Cultivars, Seeding Rate and Method; and Planting Date

Potato Type	Cultivars*	Seeding Rate	Seeding Method	Seed Depth	Planting Date
White Potatoes	Cal White, Green Mountain, Highlite, Kennebec, Russet Norkotah, German Butterball, Shepody and Yukon Gold	1500-2000 lbs/ac	Single Drop Planter	3 - 4 inches	Mid-May
Red Potatoes	Chieftain, Dark Red Norland, Cherry Red and French Fingerling	1500-2000 lbs/ac	Single Drop Planter	3 - 4 inches	Mid-May

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Alaska Soil Test Recommendation Guide Sheet: Vegetables

Vegetables

Nutrient	Area						
Nitrogen		**Soil Test Value**	**Very Low**	**Low**	**Medium**	**High**	**Very High**
Nitrogen (N), ppm	Statewide		0	10	20	30	31
	Lbs N/AC High YG *		100	100	75	50	25
	Lbs N/AC Avg YG *		100	75	50	25	10
	* High Yield Goal >10 tons/ac Average Yield Goal <10 tons/ac						
Phosphorus		**Soil Test Value**	**Very Low**	**Low**	**Medium**	**High**	**Very High**
Phosphorus (P), ppm	Kenai Peninsula		4	35	66	97	128
	Cohoe, Island,Kenai,Naptowne,Soldotna,Tustumena Soil Series						
	Lbs P_20_5/AC High YG *		200	200	150	100	50
	Lbs P205/AC Avg YG *		200	150	100	50	50
Phosphorus (P), ppm	Kenai Peninsula		4	55	107	158	209
	Beluga,Kachemak,Mutnala Soil Series and SE and SW AK						
	Lbs P_20_5/AC High YG *		200	200	150	100	50
	Lbs P205/AC Avg YG *		200	150	100	50	50
Phosphorus (P), ppm	MacKenzie-Susitna Valley		4	58	111	165	219
	Lbs P_20_5/AC High YG *		200	200	150	100	50
	Lbs P205/AC Avg YG *		200	150	100	50	50
Phosphorus (P), ppm	Matanuska Valley		43	74	105	136	167
	Lbs P_20_5/AC High YG *		200	200	150	100	50
	Lbs P205/AC Avg YG *		200	150	100	50	50
Phosphorus (P), ppm	Copper River Basin		29	52	74	97	120
	Lbs P_20_5/AC High YG *		200	200	150	100	50
	Lbs P205/AC Avg YG *		200	150	100	50	50

Alaska Soil Test Recommendation Guide Sheet: Vegetables

Phosphorus (P), ppm	Tanana Valley		6	61	115	170	225	
	Beales,Chena,Fairbanks,Gilmore,Goldstream,Nenana,Steese Soil Series							
	Lbs P_20_5/AC High YG *		200	200	150	100	50	
	Lbs P205/AC Avg YG *		200	150	100	50	50	
Phosphorus (P), ppm	Kenai Peninsula		6	39	72	106	139	
	Jarvis,Richardson,Salchaket,Tanana,Volkmar Soil Series							
	Lbs P_20_5/AC High YG *		200	200	150	100	50	
	Lbs P205/AC Avg YG *		200	150	100	50	50	
Potassium		**Soil Test Value**	**Very Low/Low**	**Medium**	**High**	**Very High**		
Potassium (K), ppm	Statewide		75	150	300	301		
	Lbs K_20/AC High YG *		180	120	60	10		
	Lbs K20/AC Avg YG *		180	90	30	10		

References

Jahns, Thomas R., Roseann Leiner and Janice I. Chumley. Alaska Mixed Vegetable Profile. University of Alaska Cooperative Extension Service Publication FGV-0040. 2007.

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